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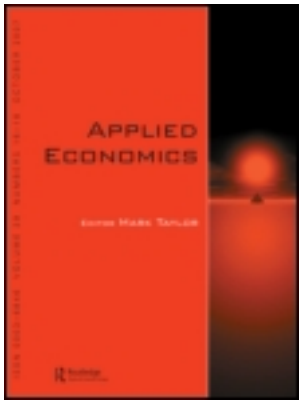

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Fiscal policy and the duration of financial crises

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Financial systems across the world have all come under pressure due to the on-going financial crisis. One of the most often asked questions during a collapse is how long and how deep will the decline be as well as what policy initiatives can be employed to shorten the recession. This study estimates a model of the duration of financial crises in an attempt to identify whether fiscal policy can reduce the time to recovery. The results suggest that fiscal shocks, which could provoke an overreaction on the part of markets, tend to lengthen crisis duration. Significant nonlinear effects of government spending are also reported in relation to trade openness and financial openness.

Keywords: financial crises; fiscal policy; duration models; financial system

JEL Classification: G01; E62; C41

I. Introduction

Rising delinquencies in the subprime mortgage market in the United States triggered turbulences in the subprime mortgage-backed securities market. The latter disturbances then spread to other markets and financial institutions, with further effects across borders, and into other economies. Consequently, the world is now experiencing an economic recession with global activity declining since 2008 and likely to continue to fall until around 2012. Both developed and developing countries have been hard hit, and the former economies are expected to register the sharpest decreases in their post-war history. There have been several suggestions to turn around global growth. For instance, Spilimbergo *et al*. (2008) argued for more concerted policy actions to stabilize financial conditions as well as sustained strong policy support to bolster demand. The Fed has responded to this suggestion by modifying the terms on which financial institutions can borrow from the *Discount Window* and the creation of new liquidity enhancing facilities like the *Term Auction Facility, the Term Securities Lending Facility and the Primary Dealer Credit Facility* (Mamun *et al*., 2010). Unfortunately, there is very little empirical evidence on how long and how deep the contraction in the world economy will be as well as what specific policy initiatives can be employed to shorten the recession.

This article estimates a model of the duration of financial crises in an attempt to identify whether fiscal policy can reduce the time to recovery. Several studies have examined the severity of currency crises. For instance, Bordo *et al*. (2000), Park and Lee (2001) and Gupta *et al*. (2003) have investigated the magnitude of deviation of output in the post-crisis years from some pre-crisis trend, following a currency crisis. However, the duration of recovery, that is, the time it takes for the crisis-hit countries to return to normalcy, and its determinants have only been assessed by a few authors. Bordo *et al*. (2000) have compared the recovery time from contractionary currency crises

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during the Gold Standard era with the post-Bretton Woods period. Their work did not recognize the wide variations in such durations both within and across countries and failed to analyse properly their determinants. Saubhik Deb (2005), however, provides a more comprehensive examination of the importance of economic fundamentals, international trade and liberalized capital account policies in investigating the speed of recovery from currency crises in both developed and developing countries. The research found that poor macroeconomic fundamentals and capital account liberalization have no significant impact on the duration of recovery, but all trade-related variables were significant.

In essence, severities of currency crises have been evaluated over and over again. Nevertheless, durations of recovery from such crises remain a mostly neglected area. This article, like Saubhik Deb (2005), aims to fill this void. It differs from Saubhik Deb (2005) in the following ways: one, this article focuses on financial crises rather than currency crises and two, it uses a different set of determinants to explain the duration of recovery. In particular, it concentrates on the effect of fiscal policy to reduce the downturns in these economies. Finally, the data are more current, ending in 2007 rather than 1999 as in Saubhik Deb (2005).

The rest of this article has been organized as follows. Section II briefly discusses the empirical model, the data and the econometric method. In Section III, the results are presented and Section IV concludes this article.

II. Empirical Approach

Econometric methodology

To model the duration of financial crises, this study uses the Cox (1972) proportional hazard framework. In this setup, the conditional hazard function, $\lambda(t|x)$, can be factored into separate functions of the instantaneous probability of leaving a state conditional on survival to time t and a vector of explanatory variables x with unknown coefficients β and λ_0. Formally

$$\lambda(t|x) = \lambda_0(t,\alpha)\phi(x,\beta) \tag{1}$$

where $\lambda_0(\cdot)$ is the baseline hazard written as a function of time only and $\phi(\cdot)$ is a function of the explanatory variables, which describes the way in which λ shifts due to differences in the independent variables and therefore the time spent in noncrisis periods. It is common to assume that $\phi(x,\beta) = \exp(x',\beta)$, as this simplifies estimation and inferences. In this framework, the coefficient β is the constant proportional effect of a given explanatory variable on the conditional probability of the spell ending.

As with most economic data, the observations on financial crises are grouped into intervals, i.e. weeks, months or years. When this is the case, the usual approach is to form a panel and estimate either a stacked logit or probit model of the probability of a crisis occurring in each period, with a different intercept for each period since in each time interval the crisis either ends or does not (Cameron and Trivedi, 2005). The general formulation of the discrete-time transition model is therefore

$$\begin{aligned}&\Pr[t_a \le T < t_a | T \ge t_{a-1}|x] \\ &\quad = F(\lambda_a + x'(t_{a-1})\beta), \quad a = 1,\ldots,A\end{aligned} \tag{2}$$

where the choices of the function F are either the standard normal Cumulative Distribution Function (CDF) or the logistic CDF. The resulting likelihood function is

$$\begin{aligned}L(\beta,\lambda_1,\ldots,\lambda_A) = \prod_{i=1}^{N}\left[\prod_{s=1}^{a_i-1}\left(1 - F\left(\lambda_s + x_i'(t_{s-1})\beta\right)\right)\right] \\ \times F\left(\lambda_{a_i} + x'(t_{a_{i-1}})\beta\right)\end{aligned} \tag{3}$$

Data and identification of crises

The study uses annual data from 1970 through 2007 for 55 developing and developed countries: Albania, Algeria, Argentina, Bangladesh, Benin, Bolivia, Brazil, Burundi, Cameroon, Central African Republic, Chad, Chile, Colombia, Congo, Republic of Costa Rica, Cote d'Ivoire, Ecuador, El Salvador, Finland, Ghana, Guinea, Guinea-Bissau, Guyana, India, Indonesia, Israel, Jamaica, Japan, Jordan, Kenya, Lebanon, Liberia, Madagascar, Malaysia, Mali, Mauritania, Mexico, Nepal, Niger, Nigeria, Norway, Panama, Peru, the Philippines, Senegal, Sri Lanka, Sweden, Thailand, Tunisia, Turkey, Uganda, the United Kingdom, the United States, Uruguay and Venezuela. The macroeconomic indicators include private consumption as a per cent of Gross Domestic Product (GDP), investment as a per cent of GDP, openness, exports, imports, current account as a per cent of GDP, per capita growth, prices, terms of trade, import reserve cover, domestic credit, liquid liabilities, money, nonperforming loans and government expenditure. These variables are taken from the *International Financial Statistics* (IFS) and the *World Development Indicators* (WDI) published by the International Monetary Fund (IMF) and the World

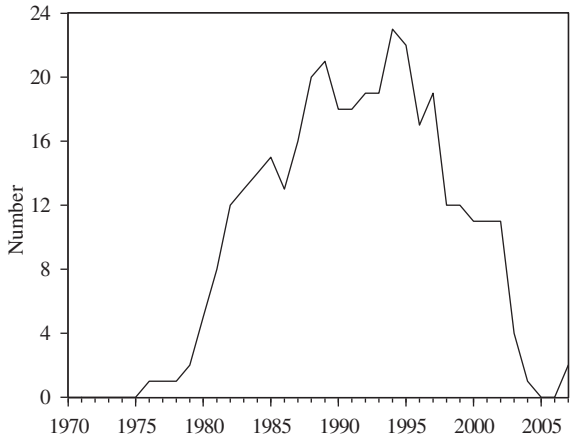

Fig. 1. Banking crises around the globe

Bank, respectively (see the Appendix for a description of the variables used in the study).

The observations on financial crises were obtained from two sources Demirgüç-Kunt and Detragiache (2005) and Laeven and Valencia (2008). Demirgüç-Kunt and Detragiache identify a financial crisis to have taken place if at least one of the following four conditions is assumed to exist: (1) the ratio of nonperforming assets to total assets in the banking system rises above 10%; (2) the cost of the rescue operation was at least 2% of GDP; (3) banking sector problems led to large scale nationalization of banks and (4) bank runs that required deposit freezes or deposit guarantees by the government. Laeven and Valencia (2008) have employed a similar approach. However, the authors excluded events that were not systemic in nature.

The database suggests that the largest number of episodes of banking distress occurred in the late to early 1990s. Figure 1 reports the distribution of financial crises over time. Between 1988 and 1995, about one-fifth of the countries included in the sample were classified as having financial systems that were in distress, peaking at 23 countries in 1994. Since this period, however, the number of financial crises across the globe has declined, particularly during the 2000 to 2005 era.

Figure 2 shows that all of the countries in the database experienced at least one financial crisis throughout the sample period. Ghana had the largest number of reported episodes of financial distress: 15 out of the 38 years under investigation. Following Ghana, Ecuador, the Philippines and the United States had the next highest number of periods of financial crisis, that is, 14. Most of the other countries registered between four and 10 episodes of financial distress. Only Panama, Jordan, El Salvador and the United Kingdom had at most two periods of financial crises.

Figure 3 shows the histogram of financial crises across the globe. An episode is defined as the period between the start and end of the crisis. On average, the duration of these crises was about 5 years: 13 out of the 78 episodes of financial crisis lasted about 5 years, that is, about 17%. Most of the remaining episodes took between 2 and 6 years.

Empirical model

The empirical model is based on the following general definition given by the G-10 Working Party on Financial Sector Consolidation (2001) which states that a crisis is 'an event that will trigger a loss in economic value or confidence in a substantial portion of the financial system that is serious enough to . . . have significant adverse effects on the real economy'. The onset of a banking crisis usually tends to be associated with depositor runs that result in the closure or takeover of several banks either by other financial institutions or government. These activities lead to further interventions elsewhere in the financial sector to assist or takeover other financial institutions.

Several factors underlie the imbalances that cause countries to experience financial crises. Two key fiscal policy variables are employed in this study: government expenditure, proxied by real government consumption and the so-called fiscal shock obtained from the residuals of a regression of real government spending on GDP. The fiscal shock variable is the traditional policy recommendation made during financial crises; it attempts to capture the additional expenditure undertaken with a goal of addressing the crisis in the financial system since not all government spending undertaken during a crisis represent fiscal injections. Hitherto, these hypotheses have not been rigorously evaluated.

Control variables are also included in the empirical model to capture those key indicators that have been found in the literature to have an important impact on the emergence of financial crises. Weak or unstable macroeconomic fundamentals have been a feature of many financial crises. Eichengreen *et al.* (1995), who were among the first researchers to examine the causes of financial crises, have found (using a sample of 20 industrial countries) that factors such as capital controls, past government deficits, past and future inflation, future GDP and employment growth and past current account balances were important determinants of currency crises (such as failed speculative attacks, devaluation, revaluation). Governments, it was argued, bring currency crises on

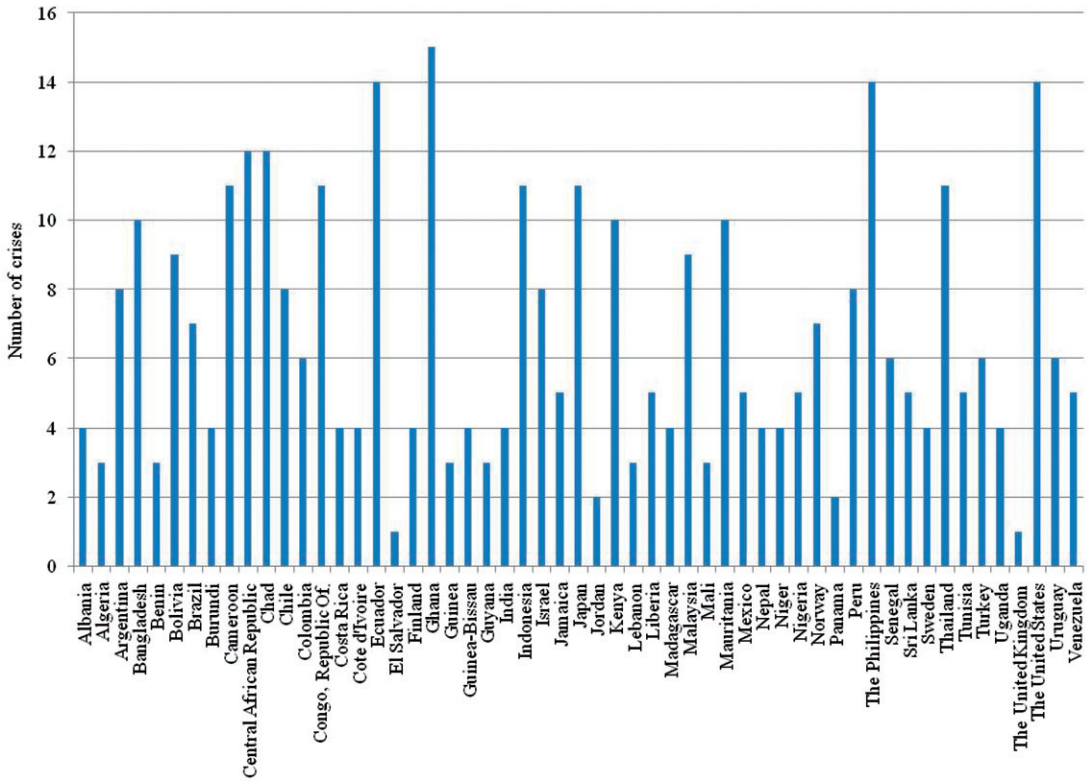

Fig. 2. Number of periods of banking crises

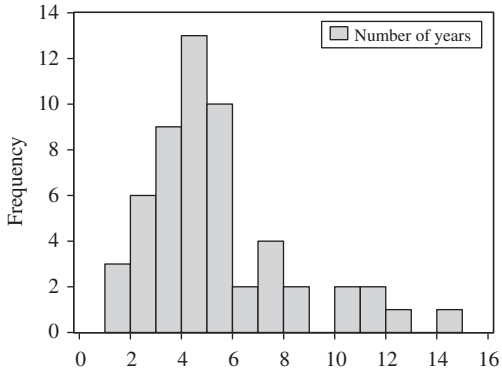

Fig. 3. Duration of banking crises

themselves through reckless expansionary policies. Alternatively, where governments do not act irresponsibly, crises occur because markets may believe that governments will shift to more expansionary policies in the abandonment of their exchange rate commitments. Park and Lee (2001), in fact, report that the depreciation of the real exchange rate, expansionary macroeconomic policies and favourable global environments are critical for the speedy post-crisis recovery. In order to control for the effects of macroeconomic conditions, the study therefore includes the detrended private consumption, investment, exports, imports and prices in order to capture the influences of large unexpected changes of these variables on the financial system. Other domestic macroeconomic factors incorporated in the model are openness, the current account balance and per capita GDP growth following Lartey and Farka (2011).

Other types of factors that have played a role in financial crises are external conditions, particularly large abrupt changes in world interest rates or the terms of trade (IMF, 1998). Frankel and Rose (1996) test whether variables like 'northern' interest rates and output and so-called external variables, such as over-valuation, the current account and the level of indebtedness and the composition of the debt, can explain currency crashes. Their results suggest that the latter tend to occur when foreign direct investment inflows dry up, when foreign reserves are low, domestic credit growth is high, 'northern' interest rates rise and when the real exchange rate is overvalued; they also tend to be associated with sharp recessions. Similar findings are reported by Sachs *et al.* (1996). Following Frankel and Rose (1996), the terms of trade, current account balance as well as an index of global financial crises are included in the empirical model to capture contagion effects.

Distortions in the financial sector coupled with macroeconomic instability form another set of indicators that can lead to financial crises. These distortions frequently occur during periods when countries are undergoing rapid financial liberalization and innovation. Weak supervision and inadequate regulatory regimes also contributed by creating environments, which influenced financial institutions to take imprudent risks. Hutchison and McDill (1999) have found that institutional characteristics such as financial liberalization and explicit deposit insurance increase the probability of banking crises. They noted in particular that the coincidence of recent financial liberalization and explicit deposit insurance together appeared to play an especially important role in creating conditions of moral hazard and increasing the probability of a banking problem occurring. The financial variables incorporated in the model used here are domestic credit, liquid liabilities, the import reserve cover, money and nonperforming loans.

III. Results

The basic duration model of financial crises (which includes all explanatory indicators except the fiscal policy variables) is estimated by Ordinary Least Squares (OLS) and maximum likelihood techniques for comparison purposes. The goodness-of-fit McFadden R^2 statistic is 0.236 and the outcome of the Hosmer and Lemeshow (1989) test was 14.112[0.079], suggesting that the actual and predicted periods of crisis are 'small'. In addition, the expectation prediction table indicates that the model is 22.3 percentage points better at predicting responses than the constant probability model. Given that the estimated model provides a reasonable representation of the duration of financial crises over the sample period, the coefficient estimates are evaluated to identify the main macroeconomic determinants of the duration of crises.

The results of the baseline duration model given in Table 1 imply that 10 out of the 16 macroeconomic indicators identified are statistically significant determinants of the duration of financial crises: private consumption, investment, openness, exports, imports, current account, growth, domestic credit and an index of global financial crises. The imports of goods and services, as well as the current account balance, domestic credit and the global index of financial crises were all positively associated with the duration of financial crises. In contrast, private consumption, investment and imports, as well as openness and per capita GDP growth were negatively correlated with the duration of financial crises. These results are broadly consistent with much of the earlier literature in the area (see, e.g. Eichengreen *et al*., 1995) that stresses the importance of macroeconomic fundamentals.

Per capita GDP growth had the largest absolute influence on the duration of financial crises, with a one percentage point rise in growth doubling the probability of exiting a crisis state. Increases in private consumption as well as investment also had relatively large negative effects on the probability of exiting a financial crisis. In contrast, balance of payments disequilibria and the deviation of imports from trend had the greatest positive impacts on the duration of financial crises.

Table 1. Macroeconomic determinants of the duration of financial crises

	OLS	Maximum likelihood
Private consumption	−0.239	−0.328
(per cent of GDP)[a]	(−2.045)	(−2.610)*
Investment	−0.140	−0.165
(per cent of GDP)[a]	(3.538)***	(−4.169)***
Openness	−0.026	−0.036
	(−1.648)*	(−2.312)**
Exports[a]	−0.072	−0.140
	(−1.375)	(−2.564)**
Imports[a]	0.071	0.143
	(1.242)	(2.438)**
Current account	0.139	0.245
(per cent of GDP)	(1.814)*	(2.666)***
Per capita growth	−0.969	−1.051
	(−6.076)***	(−6.313)***
Prices[a]	−0.022	−0.025
	(−0.640)	(−0.681)
Terms of trade[a]	−0.013	−0.042
	(−0.289)	(−0.866)
Import reserve cover	−0.032	−0.042
	(−1.640)	(−1.437)
Domestic credit	0.001	0.001
	(2.496)**	(2.309)**
Liquid liabilities	0.002	0.002
	(1.641)	(1.595)
Money	−0.002	−0.002
	(−1.560)	(−1.593)
Nonperforming loans	0.000	0.000
	(2.428)**	(1.399)
Index of global	0.017	0.019
financial crises	(15.091)***	(13.143)***
McFadden R^2	0.197	0.234
SE of regression	0.354	0.351

Notes: *z*-statistics values are provided within parentheses below the coefficients.
[a]Deviation from a linear trend value.
***, ** and * indicate significance at the 1, 5 and 10% levels of testing, respectively.

Table 2. Fiscal policy and the duration of financial crises

	Baseline	(1)	(2)
Private consumption (per cent of GDP)[a]	−0.328	−0.328	−0.325
	(−2.610)*	(−2.604)***	(−2.588)***
Investment (per cent of GDP)[a]	−0.165	−0.165	−0.158
	(−4.169)***	(−4.169)***	(−3.969)***
Openness	−0.036	−0.036	−0.006
	(−2.312)**	(−1.995)**	(−0.317)
Exports[a]	−0.140	−0.140	−0.141
	(−2.564)**	(−2.564)**	(−2.567)**
Imports[a]	0.143	0.143	0.109
	(2.438)**	(2.410)**	(1.803)*
Current account (per cent of GDP)	0.245	0.245	0.211
	(2.666)***	(2.540)**	(2.283)**
Per capita growth	−1.051	−1.052	−1.074
	(−6.313)***	(6.295)***	(6.387)***
Prices[a]	−0.025	−0.025	−0.010
	(−0.681)	(−0.679)	(−0.257)
Terms of trade[a]	−0.042	−0.042	−0.042
	(−0.866)	(−0.865)	(−0.858)
Import reserve cover	−0.042	−0.041	−0.040
	(−1.437)	(−1.436)	(−1.374)
Domestic credit	0.001	0.001	0.001
	(2.309)**	(2.028)**	(2.172)**
Liquid liabilities	0.002	0.002	0.002
	(1.595)	(1.565)	(1.411)
Money	−0.002	−0.002	−0.002
	(−1.593)	(−1.561)	(−1.437)*
Nonperforming loans	0.000	0.000	0.000
	(1.399)	(1.398)	(1.427)
Index of global financial crises	0.019	0.019	0.018
	(13.143)***	(13.140)***	(12.783)***
Government consumption	–	0.000	–
		(0.007)	
Fiscal shock	–	–	0.020
			(2.441)**
McFadden R^2	0.234	0.234	0.238
SE of regression	0.351	0.351	0.351

Note: Refer notes of Table 1.

Impact of fiscal policy

Many governments have used fiscal policy in an effort to shorten the duration and mitigate the effects of financial crises. However, the utility of such an approach is not a given. While a fiscal shock can have significant positive influences on private consumption and investment, it could also mitigate growth as policy uncertainty can have negative effects on aggregate investment and economic growth (Aizenman and Marion, 1993; Lensink *et al*., 1999). It appears then that for there to be positive outcomes from fiscal policy, the government should have a creditable reputation along the lines of Kydland and Prescott (1977).

This section of the study therefore augments the basic duration model estimated earlier with various indicators of fiscal expenditure. Table 2 gives the results. The baseline regression is offered for comparison purposes along with the regressions with indicators of total government consumption (regression 1) and fiscal shock (regression 2). Including these indicators of fiscal policy did not change the coefficients of the other explanatory variables appreciably; therefore, only coefficients on the fiscal policy variables are analysed.

The results for regression 1 suggest that the overall measure of government consumption has a statistically insignificant impact on financial crises. This finding implies that the overall level of government spending has relatively little or no impact on the duration of financial crises. When the fiscal shock variable is used, however, a different result is obtained: fiscal injections seem to have a positive and statistically significant influence on the duration of financial crises.

Table 3. Nonlinear effects of fiscal policy on the duration of financial crises

	(3)	(4)	(5)
Unanticipated × trade open	0.021 (2.175)**	–	–
Unanticipated × financial open	–	0.008 (1.965)**	–
Unanticipated × deposit insurance	–	–	0.016 (1.185)

Notes: *z*-Statistics values are provided within parentheses below the coefficients.
**Indicates significance at the 5% level of testing.

It is also possible that fiscal policy could have nonlinear effects on the duration of financial crises. To investigate this issue, the fiscal shock variable is interacted with some macroeconomic indicators that may have important impacts on the emergence and duration of financial crises: trade openness, financial openness (Dider *et al*., 2008) and the existence of a deposit insurance scheme (Hutchison and McDill, 1999). Only the interaction terms are reported for brevity, since the coefficients of the other variables did not change appreciably.

In each regression, the levels component of the variable is included along with the interaction term. Column (3) of Table 3 provides the results from the interaction between trade openness and the fiscal shock. The interaction allows one to test whether countries with more liberal trade policies are likely to experience differential effects of government spending. The findings in the table indicate that nonlinear influences are statistically significant when government-spending changes are unanticipated; in fact, unanticipated government-spending movements can lead to longer financial crises. This result suggests that in countries with higher levels of international integration, unanticipated fiscal shocks can potentially lengthen the duration of a financial crisis. This could occur if markets believe that such policy shocks are due to an unsustainable macroeconomic environment with high rates of interest and inflation as well as balance of payments disequilibria.

Much of the literature also notes that many financial crises have occurred after countries have opened their capital and financial accounts (Hutchison and McDill, 1999; Kaminsky and Reinhart, 1999). As a result, Column (4) of Table 3 also provides the findings from inter-acting the fiscal shock variable with the Chinn and Ito (2006) index of financial openness. Similar to the results for trade openness, the findings suggest that fiscal shocks tend to have statistically significant effects on countries with fewer restrictions on capital flows. Without restrictions on capital flows, participants in the market may overreact to movements in government spending leading to larger capital outflows. In countries where there are restrictions on capital flows, the impacts of this overreaction may be moderated, as investors cannot easily adjust their holdings of foreign assets.

While deposit insurance systems provide a useful safeguard for depositors in financial institutions, it also creates conditions of moral hazard as financial institutions may be more inclined to take excessive risks with the funds deposited within their institution. If this is the case, the existence of deposit insurance schemes may prolong the duration of financial crisis as these institutions are not fully penalized for their activities. The results provided in Table 3 to some extent lends credence to this assertion as the interaction between fiscal shock and the existence of a deposit insurance scheme was positive but statistically insignificant. Therefore, the existence of deposit insurance systems does not seem to influence the effectiveness of fiscal interventions.

IV. Conclusions

The 2007–2009 financial crisis in the US has led commentators to ask questions about how long and how deep the decline in real output will be as well as what policy initiatives can be employed to shorten the recession. This study estimates a model of the duration of financial crises in an attempt to identify whether fiscal policy can reduce the time to recovery. The results suggest that the overall measure of government consumption has a statistically insignificant impact on financial crises, implying that the level of government spending has no statistically significant effect in relation to shortening the duration of the crisis. However, when a fiscal shock indicator is used a different finding is obtained. The additional fiscal shock seems to lengthen the duration of financial crises. As noted by Kaminsky *et al*. (2003), maybe unanticipated fiscal shocks do not allow investors the opportunity to reduce their portfolios in an orderly fashion.

This article also investigates the nonlinear effects of fiscal policy on the duration of financial crises by interacting the fiscal shock variable with trade openness, financial openness and the existence of a deposit insurance scheme. The results for trade and financial openness variables indicate that nonlinear effects are statistically significant when interacted with the fiscal shock term. This finding suggests that in countries with higher levels of international

integration unanticipated shocks can potentially lengthen the duration of a financial crisis. This could occur if markets believe that such policy shocks could result in an unsustainable macroeconomic environment with high rates of interest and inflation as well as balance of payments disequilibria.

Similar to the findings for trade openness, the results for financial openness imply that unanticipated changes in government spending tend to have statistically significant effects in countries with fewer restrictions on capital flows. Without restrictions on capital flows, the participants in the markets may overreact to unanticipated movements in government spending leading to larger capital outflows. In countries where there are restrictions on capital flows, the impacts of this overreaction may be moderated, as investors cannot easily adjust their holdings of foreign assets.

The results provided in this study therefore seem to suggest that fiscal shocks do not reduce the duration of financial crises. Since most shocks result from a crisis of confidence, a more credible policy response seems to be able to demonstrate to the public the sustainability of government finances. This assures market participants that further stress on the financial system would not result from future government default or tax increases.

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Appendix

Variable	Description
Private consumption[a]	Detrended real private consumption as a per cent of GDP
Investment[a]	Detrended real private investment as a per cent of GDP
Openness[a]	Real exports of goods and services + imports of goods and services as a per cent of GDP
Exports[a]	Detrended real exports of goods and services as a percent of GDP
Imports[a]	Detrended real imports of goods and services as a per cent of GDP
Current account[a]	Real exports of goods and services – real imports of goods and services
Per capita growth[a]	Annual growth in real per capita GDP
Prices[a]	Detrended GDP deflator index
Terms of trade[a]	Detrended ratio export to import prices
Import reserve cover[b]	Total reserves minus gold as a ratio to the previous year's imports
Domestic credit[c]	Domestic credit to the private sector as a per cent of GDP
Liquid liabilities[c]	Liquid liabilities as a per cent of GDP
Money[c]	Money and quasi-money as a per cent of GDP
Nonperforming loans[c]	Nonperforming loans as a ratio of total loans
Index of global financial crises[d]	Number of financial crises around the globe in the current year

Sources: [a]United Nation's National Accounts Database; [b]IMF's IFS Database; [c]World Bank's WDI Database; [d]Demirguc-Kunt and Detragiache (2005).